

BULLETIN OF THE
PENNSYLVANIA
Department of Agriculture
HARRISBURG, PA.

Vol. 1.

DECEMBER, 1918

No. 12.

GENERAL BULLETIN NO. 319

LIME REPORT
1918

JAMES W. KELLOGG, Chief Chemist
BUREAU OF CHEMISTRY



Published Monthly by Direction of

CHAS. E. PATTON, *Secretary of Agriculture*, Harrisburg, Pa.

Entered as second class matter, March 22, 1918, at the Post Office at Harrisburg, Pa., under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on June 29, 1918.

HARRISBURG, PENNA.:

1918

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DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY

PRODUCTS ANALYZED

OFFICIAL SAMPLES SECURED BY SPECIAL AGENTS

FERTILIZERS	FEEDING STUFFS	LINSEED OIL
PAINT	PUTTY	TURPENTINE
LIME	SEEDS	

SPECIAL SAMPLES FOR RESIDENTS OF THE STATE

LIME, \$1.00	LINSEED OIL, \$1.00
FEEDING STUFFS, \$1.00	SEEDS, 25c



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LETTER OF TRANSMITTAL

DEPARTMENT OF AGRICULTURE BUREAU OF CHEMISTRY

Harrisburg, Pa., December 12, 1918.

Hon. Charles E. Patton,
Secretary of Agriculture,
Harrisburg, Pa.

Dear Sir:—

I have the honor to present herewith for your approval a report showing the results of analyses of the official samples of Lime Products received during 1918 from the sampling agents of the Department.

It is recommended that this report be published in bulletin form for distribution.

Very respectfully,
JAMES W. KELLOGG,
Chief Chemist.



LIME REPORT

1918

INTRODUCTION

As a result of the inspection of Lime Products during the Spring and Fall seasons of 1918, the sampling Agents of the Department selected 184 samples of the various brands of agricultural lime found being sold in the State, and forwarded them to the Bureau of Chemistry for chemical examination. As, in many cases, duplicate samples of one or more brands were received, it did not appear advisable to analyze each sample secured and consequently of this number, 138 were analyzed for the purpose of determining whether or not the guarantees claimed correctly represented the composition of these products.

The lime products coming within the provisions of the lime law included four principal forms, namely, Lime Carbonates or Pulverized Limestone, Artificial Carbonates of Lime and Marl; Lime, the product obtained by burning limestone; Hydrated Lime and Gypsum or Land Plaster. There were 45 different brands, the output of 38 companies representing the agricultural lime registered and offered for sale in the State. The number of samples of each group or class analyzed were as follows: Pulverized Limestone, 29; Artificial Carbonate of Lime, 13; Marl, 3; Lime, 6; Hydrated Lime, 81; Gypsum or Land Plaster, 3 and 3 samples classed as Miscellaneous including "Berkley Hydra-Calcite" and a brand labeled "Agricultural Lime" being a by-product obtained from a chemical manufacturing process for which no guarantees had been filed with the Department. Each sample was analyzed for its content of calcium oxide, magnesium oxide and insoluble matter, and in the case of Pulverized Limestone and Artificial Carbonate of Lime, determinations were made for the degree of fineness or state of pulverization by means of sieving, showing the number of sieve mesh through which the coarsest particles would pass as well as the portions passing a No. 10, No. 50 and No. 100 mesh sieve. In the samples of Lime, the product derived from burning limestone, determinations were made for carbon dioxide which indicates to what extent the process of burning has been effected and the

amount of "core" or unburned limestone remaining in the sample. In the case of Gypsum which is in the form of sulphate of calcium, determinations were made for calcium oxide and sulphur trioxide, as required.

The results of the year's inspection work shows that nearly one-half of the samples received contained less calcium oxide than guaranteed thus indicating the need of greater care in labeling and guaranteeing these products in order to comply with the requirements of the law. The deficiencies were more numerous in the samples of Hydrated Lime than in the other classes and in many cases, as will be noted, where the calcium oxide was deficient, the magnesium oxide was found to exceed the guarantees thus in a measure offsetting or balancing the lime deficiencies. It is recognized that both calcium and magnesium oxides have equal value for soil amendment in correcting acidity and assisting in rendering available the various forms of plant food. Many shipments from which samples were secured for analysis were found not to be properly labeled as required by the law, the containers not showing correct and complete guarantees for calcium and magnesium oxides and also several cases where these products were found being sold in bulk, cards were not attached to bins or at hand to furnish purchasers as required. Greater care should, therefore, be taken on the part of dealers in making sure that agricultural lime products are properly labeled and guaranteed. It is recognized that different strata of lime rock will vary somewhat in composition, accordingly resulting in the prepared products varying in their contents of calcium and magnesium oxides, however, as the law provides for the analysis of special samples, it is easily possible for the Department to furnish Manufacturers and selling Agents located in the State with the analysis of their products. By taking advantage of obtaining this information, guarantees can be so fixed that they will represent the average analysis of the Lime Products offered for sale.

There seems to be, from the information secured at the time of selecting samples, no uniformity in the retail selling prices for the various grades of lime products sold in the State. In the case of Pulverized Limestone, the retail prices ranged from \$4 to \$14 in samples analyzing approximately 50 per cent. of total calcium and magnesium oxides, averaging \$7.39 a ton. The brands of Artificial Carbonate of Lime were offered for from \$2.60 to \$12, analyzing 48.85 per cent. and 53.83 per cent. total calcium and magnesium oxides respectively, and averaged \$9.01 a ton. The prices received for the 3 samples of Marl showed but little variation, the average being \$9.50 a ton, analyzing 49.21 per cent. of calcium and magnesium oxides. The retail prices for the 6 samples of Burned Lime were from \$5.25 in a sample containing 63.89 per cent. to \$11 in one containing 69.56 per

cent. of total calcium and magnesium oxides respectively, the average being \$7.43 a ton. A marked variation in the retail selling prices for Hydrated Lime was also noted ranging from \$8 to \$15, averaging \$11.46 a ton. The brand having the lowest selling price contained 67.61 per cent. total oxides, being 5.53 per cent. in excess of the brand having the highest selling price. A higher selling price was noted in this class of products, which was excluded from the average and not considered as being representative, as it was estimated from the price for one sack. The prices for the 3 samples of Gypsum averaged \$17.33 a ton. It is evident from these figures, therefore, that purchasers should consider carefully the guarantees for the various grades of Lime Products and the prices charged before deciding as to what brands should be purchased. It will be noted by referring to the tables showing the analyses and retail selling prices that in many cases those brands selling for the lower values contained greater amounts of calcium and magnesium oxides, the elements necessary and of value in soil amendment, than those which sold for the higher retail prices.

Under the provisions of the Law providing for the analysis of special samples for residents of the State for a fee of \$1.00 for each sample, 11 such samples were received during the year, accompanied by the required fee and blanks filled in with the information required for the files of the Department. As soon as possible after the completion of the analysis of each sample, reports were submitted to the senders and the fees received were paid to the State Treasurer in the usual manner.

The results of analyses for each sample, the brand names, names and addresses of Manufacturers, Importers and Selling Agents, together with guarantees and retail prices, have been tabulated and are included in the following pages for comparison. Table I includes: Pulverized Limestone, Artificial Carbonate of Lime and Marl; Table II, Lime and Hydrated Lime; Table III, Gypsum or Land Plaster and Table IV, Miscellaneous samples. The following pages also include a copy of the Lime Law, comments regarding registration, required labeling, analyses of special samples, average analyses and retail prices, a discussion of the results of inspection, and factors used in calculating the various forms in which calcium and magnesium are present in the several classes of Lime Products.

ACKNOWLEDGMENTS.

The reception and preparation of samples and the immediate supervision of the analytical work were in charge of Mr. V. B. Hausknecht, First Assistant Chemist, who also made duplicate analyses and check determinations where required. The chemical analyses of the samples were made by Messrs. William Weber, G. J. Kuhlman, Jr., and Frank B. Williams. The samples were prepared for analysis by Messrs. H. B. Wible and W. W. Cassel.

LIME LAW.

The Lime Law is included herewith in order that its requirements may be fully understood. A careful study of it will show the information required to be placed on sacks or packages, the kind or class of materials required to be labeled and guaranteed, the fee charged for registration and the penalties for failure to comply with its requirements.

No. 306.

AN ACT

To regulate the sale for agricultural purposes of crushed limestone, lime, gypsum, and related products; defining said products; and prescribing penalties for the violation of this act.

Section 1. Be it enacted, &c., That every bag, barrel, or other package or quantity, of any pulverized limestone, ground oyster shells, artificial carbonate of lime, ground lime, spraying lime, slacked-lime, hydrated lime, hydrated spraying lime, marl, gypsum, or land-plaster, sold, offered, or exposed for sale, within this Commonwealth for use as a soil amendment or as an ingredient or reagent in the preparation of any fungicide or insecticide, shall have attached to it or be accompanied, in a manner provided in section three hereof, by a plainly printed statement giving the name and address of the manufacturer or importer and his place of business, the brand or trade-made of said material, the net weight of the contents of the package, when sold in package, and a statement declaring, with respect to pulverized limestone, ground oyster shells, and artificial carbonate of lime: (a) The degree of fineness of the material, in terms of the minimum sieve-mesh, expressed in fractions of an inch, through which the coarsest particles of said material can pass; and (b) the minimum percentages contained of available oxides of calcium and magnesium, respectively, combined as carbonates; with respect to lime,

ground lime, spraying lime, slacked-lime, hydrated lime, hydrated spraying lime, and marl, the minimum percentages contained of the available oxides of calcium and magnesium, respectively; and with respect to gypsum, or land-plaster, the minimum percentages contained of available calcium oxide and sulphur trioxide, or sulphuric acid (SO^3) respectively; which statement shall be held to be the guaranty of the manufacturer or importer that the goods to which said statement refers are of the kind and quality, or composition and fineness, so set forth. The provisions of this act shall not, however, apply to air-slacked lime, kiln-slaks, gas-house lime, or tanners' lime, when sold as such.

Section 2. For the purpose of this act, the materials named in the foregoing section are defined as follows:—

(1) Limestone is the rock commonly known by that name, and consisting chiefly of calcium carbonate, or of said carbonate with a smaller molecular proportion of magnesium carbonate.

(2) Pulverized limestone is limestone reduced by mechanical means to a fine powder.

(3) Artificial carbonate of lime is carbonate of lime artificially produced by any method other than the exposure of lime, ground lime, slaked-lime, hydrated lime, or spraying lime to the action of the atmosphere.

(4) Lime is the product obtained by the complete burning of limestone in a kiln, and capable of being reduced by slaking to a fine powder.

(5) Ground lime is lime reduced to a fine powder by grinding.

(6) Spraying lime is lime of high purity, containing not less than ninety-three per centum of calcium oxide and not more than five per centum of magnesium oxide, not more than five per centum of carbon dioxide, nor more than five per centum of acid insoluble matters, iron or aluminum oxides, collectively.

(7) Slaked lime is the dry finely divided product obtained by the addition of later to lime.

(8) Hydrated lime is slaked-lime prepared by the aid of stirring, or of stirring, grinding, and screening machinery, and is free from hard lumps.

(9) Hydrated spraying lime is dry finely divided hydrated lime of purity not less, after taking the water of hydration into account, than that herein required in the case of spraying lime, and of such fineness that all shall pass a standard sieve of one hundred meshes to the inch.

(10) Air-slaked lime is the more or less finely divided product obtained when lime, slaked-lime, hydrated lime, or spraying lime is exposed for a considerable time to the action of the air.

(11) Marl is clay highly charged with carbonate of lime. Shell marl is marl in which the carbonate of lime is present chiefly in the form of molluscan shells.

(12) Gypsum, or land-plaster, is the finely divided mineral, commonly known by that name, and consisting chiefly of calcium sulphate.

(13) Kiln-slaks is refuse lime mixed with ashes and "core," or imperfectly burned limestone.

(14) Gas-house lime is spent lime that has been used as a purifier in the manufacture of illuminating gas.

(15) Tanner's lime is spent lime that has been used in the curing of hides.

Section 3. The statement required by section one of this act shall, in the case of goods sold in package, be plainly printed upon the package, or upon a tag or label fastened thereto, of such quality and in such manner that it shall not be detached in handling, and, in the case of goods sold in bulk, the said statement shall be delivered to the purchaser either with the invoice therefor or with the goods.

Section 4. Every manufacturer or importer of one or more of the materials named in section one of this act, for either or both of the purposes therein stated, shall, on or before the first day of January of each year, or before offering them for sale in this Commonwealth for either of said purposes, file annually with the Secretary of Agriculture a statement of the names and number of brands of such materials having distinct trade-names that he shall offer for sale, for either or both of said purposes, during the next ensuing calendar year or remainder thereof, together with a copy of the statement declaring the composition of these several brands of said materials, as required by section one of this act.

Section 5. In addition to the statement required by section four of this act, every manufacturer or importer of any of the materials named in section one of this act shall on or before the first day of January of each year, or before offering them for sale within this Commonwealth, file annually with the Secretary of Agriculture an affidavit showing, as nearly as practicable, the weight of each brand of said materials sold by him, or, if the producer or vendor be a firm or corporation, by its managers, officers, and agents, within this Commonwealth, for either or both of the purposes named in section one of this act, during the last preceding year; and for each brand so sold he shall pay to the Secretary of Agriculture a license fee, according to the weight sold, as follows: For an amount exceeding one hundred tons, but not exceeding one thousand tons, five dollars; for an amount exceeding one thousand tons, but not exceeding five thousand tons, ten dollars; and for an amount exceeding five thousand tons, twenty dollars; and when said fees shall have been paid, and the statements

required by section four of this act have been filed with the Secretary of Agriculture, the party or parties who have made such payment, and otherwise complied with the provisions of this act, shall be entitled to sell within the Commonwealth the goods specified in said statement and covered by said fees during the year, or fraction of a year, immediately following said statement. If the manufacturer or importer shall not have made during the preceding year any sales within the Commonwealth, for the aforesaid purposes, of any brand to be offered for sale during the year for which the fee is to be paid, he shall pay for each such brand a fee of five dollars. All moneys so received shall be immediately paid by the Secretary of Agriculture into the State Treasury, for the use of the Commonwealth.

Section 6. Any person or persons selling, offering, or exposing for sale, for either of the purposes stated in section one of this act, any of the materials named therein or brand of the same, unless accompanied by the statement required by section one of this act, or, when so accompanied, if the said statements shall be false in any particular, or without having complied with all the foregoing provisions of this act, shall be guilty of a misdemeanor; and on conviction shall be sentenced to pay a fine of not less than ten nor more than fifty dollars for the first offense, and not less than one hundred dollars for each subsequent offense. It shall be the duty of the Secretary of Agriculture to enforce the provisions of this act; and all penalties, costs, and fines received shall be paid to him or his duly authorized agent, and by him shall be immediately paid into the State Treasury, for the use of the Commonwealth.

Section 7. The Secretary of Agriculture is hereby empowered to collect samples of the materials named in section one of this act, either in person or by his duly qualified agent or representative, to have them analyzed, and to publish the results for the information of the public; and for this purpose the said Secretary of Agriculture, such assistants, agents, experts, chemists, detectives, and counsel as he shall duly authorize, shall have full access, ingress, and egress to and from all places of business, quarries, kilns, factories, barns, buildings, carriages, cars, and vessels used in the manufacture, storage, transportation, or sale of any of the said materials. They shall also have power to open any package or vessel containing or supposed to contain any of the said materials, and to take therefrom samples for analysis, upon tendering the value of said samples. Any manufacturer or producer of any of the materials named in section one of this act, located in the Commonwealth, shall be entitled to have a single sample of any distinct brand, for the sale of which he has paid the fee required by section five of this act, analyzed by the Department of Agriculture, under such regulations as the Secretary of Agriculture may prescribe with respect to the points of composition speci-

fied in said section one, upon sending sample properly sealed and carriage prepaid, together with a fee of one dollar for each such analysis; but not more than two brands shall be analyzed, under the privilege conferred by this proviso, for one manufacturer or producer in a single year. None of the provisions of this act shall apply to sales of limestone, or limestone products or marl, when such sales are made at the quarry or pit in bulk, and delivered to the wagons of the users, who are presumed to be acquainted with the qualities of the local products.

Section 8. To carry out the provisions of this act for the period ending June first, one thousand nine hundred and seventeen, the sum of four thousand dollars (\$4,000), or so much thereof as may be necessary, is hereby specifically appropriated to the Department of Agriculture.

Section 9. This act shall go into effect on the first day of January, one thousand nine hundred and sixteen.

Approved—The 1st day of June, A. D. 1915.

MARTIN G. BRUMBAUGH.

REGISTRATIONS.

Every brand of Lime Products sold in the State for agricultural purposes is required to be registered with the Department of Agriculture, on or before January 1st of each year. In filing registrations and securing licenses for one or more brands it is also necessary to file at the same time an affidavit showing the weight of each brand of material sold during the last preceding year in order that the license fee required to be paid can be estimated. The license fees are from Five Dollars (\$5.00) to Twenty Dollars (\$20.00) for each brand according to the number of tons sold during the last preceding year, as will be noted by referring to the foregoing copy of the Law. The guarantees for the minimum percentages of calcium oxide and magnesium oxide are required to be shown in registrations and these same guarantees should be printed upon sacks or attached cards. When agricultural lime is sold in bulk, such cards should be attached to the bins or at hand to furnish purchasers. In the case of Pulverized Limestone and Artificial Carbonate of Lime, the percentages of calcium and magnesium oxides estimated as calcium carbonate and magnesium carbonate should also be shown. Any firm located in the State who does not have the analysis of the materials to be registered, and therefore is not in a position to fix guarantees, can secure this information from the Department for a small fee by submitting

special samples for analysis, as shown elsewhere in this report. Before Lime Products are offered for sale, producers should make application for registration and licenses to the Secretary of Agriculture, Hon. Charles E. Patton, Harrisburg, Pa.

REQUIRED LABELING.

The requirements of the law with respect to labeling are as follows: Except in the case of air-slaked lime, kiln-slaks, gas-house lime and tanners' lime, when sold as such, all sacks or containers or attached cards, are required to be printed, or if sold in bulk, a statement delivered to the purchasers, showing the number of net pounds, brand name or name of product, name and address of Manufacturer or Importer and guaranteed analysis. The guarantees required vary for each class of lime product and minimum guarantees only should be used as the use of both minimum and maximum, or so called "sliding guarantees" are considered contrary to the requirements. The guarantees required for each class of products are as follows:—

Pulverized limestone, ground oyster shells and artificial carbonate of lime: Minimum guarantees for calcium oxide and its equivalent as calcium carbonate; magnesium oxide and its equivalent as magnesium carbonate, and the degree of fineness showing the number of sieve mesh through which the coarsest particles will pass.

Lime, ground lime, spraying lime, slaked lime, hydrated lime, hydrated spraying lime and marl. Guarantees for the minimum percentages of calcium oxide and magnesium oxide.

Gypsum or Land Plaster: Guarantees for the minimum percentages of calcium oxide and sulphur trioxide.

ANALYSES OF SPECIAL SAMPLES.

Under certain conditions the Department will analyze special samples of lime products for residents of the State, as provided for by the law, for the fee of \$1.00 per sample. Parties wishing to take advantage of this provision should first write to the Department making a request for the analysis of a sample, and fill out and return a blank form which will be sent, together with the amount of fee charged and then should proceed as follows:

Amount of Sample:—Portions should be carefully taken from several sacks of the shipment, or if in bulk, from several different places

and carefully mixed to insure as uniform and as representative a sample as can be obtained. After thoroughly mixing, at least a one-pound sample should be placed in a suitable container and sent to the Department.

Charge for Analysis:—A charge of one dollar (\$1.00) is made for each sample analyzed, determinations being made for calcium oxide, magnesium oxide and insoluble matter. The fee should be sent in the form of a check, money order or cash.

Address:—Both sample and letter enclosing fee and filled out form should be sent to the Bureau of Chemistry, Pennsylvania Department of Agriculture, Box 108, Harrisburg, Pa. The name of the sender should be plainly written on the package containing sample. If more than one sample is submitted, each should be identified by a number, letter or name.

AVERAGE ANALYSES AND RETAIL PRICES.

While the analyses and selling prices of a small number of samples cannot be claimed to be entirely or completely representative of certain brands of Lime Products, such information is of value in proportion to the brands and samples examined, in assisting prospective purchasers and others interested to a knowledge of the character of these products as shown by the samples received and analyzed during the year. The following Table gives the number of samples and the average analyses and retail selling prices of the several classes of Lime Products analyzed:

Classes of Lime Products.	Number of samples.	Moisture.	Calcium oxide.	Magnesium Oxide.	Sulphur tri-oxide.	Insoluble matter.	Price per ton.
		%	%	%	%	%	
Pulverized Limestone, -----	29	0.09	46.31	4.32	-----	7.54	\$7 39
Artificial Carbonate of Lime, -----	13	2.60	50.31	2.58	-----	1.47	9 01
Marl, -----	3	3.07	48.35	0.86	-----	5.19	9 50
Lime, -----	6	-----	66.08	9.00	-----	4.52	7 43
Hydrated Lime, -----	81	-----	58.39	12.39	-----	2.61	11 46
Gypsum, -----	3	8.77	32.86	-----	41.99	2.28	17 33

The above average prices are in excess of those reported for the brands received during 1917, while the average analyses show no marked changes in comparing the two year's products except in the case of Lime where the total average contents of calcium and mag-

nesium oxides is several per cent. higher than the average for this same material for last year. The average price for the brands of Pulverized Limestones is 60 per cent. higher than the average for the brands received in 1917 and the approximate increases for the remaining classes were for Artificial Carbonate of Lime 19 per cent., Marl 38 per cent., Lime 24 per cent., Hydrated Lime 25 per cent., and Gypsum 44 per cent. Based on the average analyses and considering the total average contents of calcium and magnesium oxides, the average prices shown would indicate that the number of pounds of total elements necessary in correcting soil acidity supplied for \$1.00 in the several classes would be as follows: Pulverized Limestone 137.0 lbs., Artificial Carbonate of Lime 117.4 lbs., Marl 103.6 lbs., Lime 202.1 lbs., and Hydrated Lime 123.5 lbs.

In the case of Gypsum a comparison of the amount of calcium oxide supplied and the selling prices with the other classes of materials, would be out of proportion owing to its lower content of calcium oxide and to the fact that the function of Gypsum or Land Plaster is different from the Carbonates of Lime, Hydrated Lime and Burnt Lime, as it is not adapted to correcting soil acidity but is of value in fixing and holding ammonia and aiding in rendering other forms of plant food more available. From the number of pounds of elements supplied in the several groups for \$1.00, it will be noted that the greatest number of pounds can be purchased in the case of Lime. While these figures will show the amount of elements supplied by each class as shown by averages, the fact should not be lost sight of that much depends on the kind of agricultural lime desired or needed, as in certain cases one grade or kind would be more desirable and would be used to better advantage than another. Insofar as the neutralization of soil acidity is concerned, however, the calcium and magnesium oxides present are the elements to be considered in performing this work.

DISCUSSION OF RESULTS OF INSPECTION.

As already shown, there are 3 grades of Lime Products in which the calcium as well as the magnesium contained therein is combined with calcium dioxide forming carbonates of lime, namely, raw ground rock or pulverized limestone, precipitated or Artificial Carbonate of Lime and Marl. The Artificial Carbonate of Lime is a chemical preparation resulting from manufacturing processes, while Marl is obtained as a natural deposit of clay containing calcium and magnesium largely in the form of carbonates. Of the 29 samples of Pulverized Limestone analyzed, representing 11 different brands, nearly

one-half of this number were found to contain approximately 1 per cent. less calcium oxide than guaranteed, as will be noted by referring to Table I showing the results of analyses of each sample. Nearly all were guaranteed for calcium oxide and several were guaranteed for calcium in the carbonate form. In many cases where the content of calcium oxide was found to be low, the magnesium oxide exceeded the amounts claimed, thus, in a measure, overcoming the calcium deficiencies. The composition of these products was variable as would be expected in materials of this kind. The calcium oxide content varied from 28.59 per cent. in a sample of dolomite origin containing 19.52 per cent. magnesium oxide, to 55.29 per cent. calcium oxide in a low magnesium rock which contained 0.76 per cent. magnesium oxide, the average being 46.31 per cent. The percentages of magnesium oxide found were from 0.54 per cent. to 22.13 per cent. in a brand containing 28.84 per cent. calcium oxide averaging 4.32 per cent. There were 4 samples of Limestone of dolomite origin running low in calcium oxide and high in magnesium oxide, the analysis of which were as follows: 19.18 per cent. magnesium oxide with 29.16 per cent. calcium oxide and 22.13 per cent. magnesium oxide with 28.84 per cent. calcium oxide. The magnesium oxide varied from 0.54 per cent. to 22.13 per cent., averaging 4.32 per cent. The oxide percentages calculated to the carbonate forms averaged 82.60 per cent. calcium carbonate and 9.05 per cent. magnesium carbonate. The determinations for acid insoluble matter gave figures of from 0.49 per cent. to 13.30 per cent. averaging 7.54 per cent. As a result of the determinations for the degree of fineness, all the samples were found to be fine enough so that the coarsest particles would pass a No. 10 mesh sieve, the majority passing through a No. 20, several being fine enough to pass a No. 30 and a No. 40 mesh sieve. The average degree of fineness indicated that 86.4 per cent. of the Pulverized Limestones would pass a No. 50 and 76.2 per cent. would pass a No. 100 mesh sieves, thus indicating that this class of products was in a good state of pulverization.

The 13 samples, including 3 brands, classified as Artificial Carbonate of Lime showed that they did not differ materially from the composition of the Pulverized Limestones except that they contained less acid insoluble matter averaging 1.47 per cent. Seven of these samples were found to contain less calcium oxide than claimed, however, in all but 2 of these cases, the magnesium oxide exceeded the guarantees thus largely offsetting the calcium deficiencies. The contents of calcium and magnesium oxides varied from 46.99 per cent. and 0.49 per cent. to 52.63 per cent. and 6.60 per cent., averaging 50.31 per cent. and 2.58 per cent. respectively. The averages in terms of carbonates were 89.56 per cent. calcium carbonate and 5.40 per cent. magnesium carbonate. The tests for the degree of fineness showed

that upon an average, the coarsest particles would pass a No. 10 mesh sieve and the average respective percentages which would pass a No. 10, No. 50 and No. 100 mesh sieve were 98.9 per cent., 75.1 per cent. and 65.4 per cent.

The analyses of the 3 samples of Marl representing 1 brand showed very little variation in their composition, all exceeding their guarantees, the average composition being as follows: calcium oxide 48.35 per cent. equivalent to calcium carbonate 86.25 per cent.; magnesium oxide 0.86 per cent. equivalent to magnesium carbonate 1.79 per cent. The insoluble matter averaged 5.19 per cent. The detailed results of analysis of these 3 classes of products will be found in Table I.

There were only 6 samples analyzed representing as many brands of Lime, commonly known as burned lime, resulting from the burning or calcining of raw rock used. Three of these were found to contain less calcium oxide than guaranteed, 2 of this number exceeding the guarantees for magnesium oxide. The calcium oxide showed variations of from 51.71 per cent. to 89.82 per cent., averaging 66.08 per cent. and the magnesium oxide found was from 1.23 per cent. to 37.33 per cent., averaging 9.00 per cent. This high content of magnesium oxide was present in a sample of dolomite origin analyzing 54.00 per cent. calcium oxide. In this class of materials, determinations were made for carbon dioxide, which represents the amount of unburned limestone or "core" remaining in the sample, which is an index of the thoroughness with which the burning process has been performed. The amounts noted in these few samples were from 0.35 per cent. to 13.22 per cent. averaging 6.59 per cent. As each percentage of carbon dioxide indicates that 2.2757 per cent. is approximately the amount of "core," the average carbon dioxide found would show that approximately 15 per cent. of unburned limestone was not affected by the process of burning. These figures, however, because of the small number of samples included, cannot be claimed to fairly represent the product. The amounts of insoluble matter ranged from 1.03 per cent. to 8.78 per cent., averaging 4.52 per cent.

The largest number of samples received were those of Hydrated Lime prepared by the addition of water to lime in the process known as "slaking" and the calcium and magnesium present in the same is, therefore, largely in the form of calcium and magnesium hydrates. There were 81 samples representing 21 brands analyzed which contained from 43.80 per cent. to 73.69 per cent., averaging 58.39 per cent. calcium oxide and from 0.83 per cent. to 32.79 per cent., averaging 12.39 per cent. magnesium oxide. All of these samples were guaranteed and nearly half of them failed to meet the guarantees given for calcium oxide. In 10 cases where the calcium oxide was found to be deficient, the magnesium oxide exceeded the claims made. There were 19 samples containing a high content of magnesia being there-

fore, largely derived from dolomite rock, containing from 9.60 per cent. to 32.79 per cent. magnesium oxide. Those brands carrying the lower amounts of magnesium oxide ranged from 0.83 per cent. to 7.98 per cent. The insoluble matter in Hydrated Limes, as a rule, is low and in the samples analyzed averaged 2.61 per cent., ranging from 0.02 per cent. to 10.40 per cent. and 15.84 per cent., the two highest in insoluble matter noted. Estimating the calcium and magnesium oxides in the Hydrate form from the average analysis would show that this class of products would contain approximately 77.13 per cent. calcium hydrate and 17.93 per cent. magnesium hydrate. The results of analysis of each sample of Lime and Hydrated Lime will be found in Table II.

The lime product Gypsum, commonly known as Land Plaster, was represented by only 3 samples of 1 brand as shown in Table III, the composition of which is fairly constant. The average of the results secured was 32.86 per cent. calcium oxide, 41.99 per cent. sulphur trioxide which being estimated as Gypsum or calcium sulphate averaged 71.42 per cent. The insoluble matter was low averaging 2.28 per cent.

The 3 samples classified as Miscellaneous included 1 brand of "Agricultural Lime" analyzing 58.78 per cent. calcium oxide, 0.72 per cent. magnesium oxide, selling for \$6.00 a ton, and two samples of "Berkley Hydra-Calcite" which average 59.41 per cent. calcium oxide, 1.80 per cent. magnesium oxide and had an average selling price of \$7.83 a ton. The results of analyses of these samples will be found in Table IV.

LIME FACTORS

In estimating the composition of the several classes of lime products, it is necessary to employ certain factors, which are derived from the chemical formulas representing them. As previously shown determinations are made for calcium oxide, magnesium oxide, carbon dioxide and sulphur trioxide. Carbonate of Lime is represented by the formula CaCO_3 , Carbonate of Magnesia by MgCO_3 , Gypsum or Calcium Sulphate by CaSO_4 , Hydrated Lime by $(\text{OH})_2$, and Magnesium Hydrate by $\text{Mg}(\text{OH})_2$. To estimate the amounts of these forms or combinations the percentages of Calcium Oxide and Magnesium Oxide secured are multiplied by their respective factors. In order that these factors may be at hand for reference, they are included herewith as follows:—

Given.	Required..	Factor.
Calcium oxide,	Calcium hydrate,	1.321
Calcium oxide,	Calcium carbonate,	1.7839
Calcium oxide,	Calcium sulphate,	2.4265
Calcium hydrate,	Calcium oxide,7570
Calcium carbonate,	Calcium oxide,5606
Calcium sulphate,	Calcium oxide,4121
Magnesium oxide,	Magnesium hydrate,	1.4468
Magnesium oxide,	Magnesium carbonate,	2.0913
Magnesium hydrate,	Magnesium oxide,6912
Magnesium carbonate,	Magnesium oxide,4782
Calcium oxide,	Sulphur trioxide,	1.4265
Carbon dioxide,	Calcium carbonate,	2.2757
Carbon dioxide,	Magnesium carbonate,	1.9159
Calcium carbonate,	Carbon dioxide,4394
Sulphur trioxide,	Calcium sulphate,	1.701

TABLE I.—PULVERIZED LIMESTONE,

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—	Moisture.
PULVERIZED LIMESTONE.			%
BESSEMER LIMESTONE CO., YOUNGSTOWN, OHIO.			
C-391	Bessemer Pulverized Limestone, -----	Hartwell & Philips, New Wilmington,	0.19
C-480	Bessemer Pulverized Limestone, -----	S. Leroy Tuttle, Franklin, -----	0.28
THE CARBON LIMESTONE CO. YOUNGSTOWN, OHIO.			
C-431	Carbon Agricultural Limestone, -----	R. G. Allison, Ambridge, -----	0.22
C-517	Carbon Agricultural Limestone, -----	Alex. Trent, Coleman, -----	0.00
CENTRE COUNTY LIME CO., BELLEFONTE, PA.			
C-361	Ground Agricultural Limestone, -----	E. M. Fullington, Clearfield, -----	0.19
F. E. CONLEY LIME AND FERTILIZER Co., UTICA, N. Y.			
C-393	Raw Ground Lime (Ground Limestone), -----	George R. Clark, Scranton, -----	0.02
THE EDISON PULVERIZED LIME- STONE CO., STEWARTSVILLE, N. J.			
C-448	Edison Pulverized Limestone, -----	Frank P. Best, Bath, -----	0.07
C-444	Edison Pulverized Limestone, -----	R. H. Clift, Prompton, -----	0.08
C-392	Edison Pulverized Limestone, -----	J. B. Cokely, Scranton, -----	0.08
C-459	Edison Pulverized Limestone, -----	B. J. Gardner, Factoryville, -----	0.04
C-438	Edison Pulverized Limestone, -----	M. W. Lewis, Hills Grove, -----	0.19
C-414	Edison Pulverized Limestone, -----	T. F. Leonard, Scranton, -----	0.05
C-464	Edison Pulverized Limestone, -----	T. F. Leonard, Scranton, -----	0.02
C-395	Edison Pulverized Limestone, -----	C. P. Matthews & Sons, Moscow, -----	0.04
C-418	Edison Pulverized Limestone, -----	Murry Co., Honesdale, -----	0.00
C-445	Edison Pulverized Limestone, -----	A. Rohmann, Stroudsburg, -----	0.06
C-348	Edison Pulverized Limestone, -----	Amos Snyder, Hegins, -----	0.06
C-466	Edison Pulverized Limestone, -----	M. Stipp, Wimmers, -----	0.03
G. W. JOHNSON LIMESTONE CO., NEW CASTLE, PA.			
C-457	Johnson's Pulverized Limestone, -----	S. N. Moore, Echo, -----	0.22
LEHIGH PULVERIZED LIMESTONE CO., ALLENTOWN, PA.			
C-470	"Lehigh" Pulverized Limestone, -----	Harry Hartman, New Ringgold, -----	0.04
C-358	"Lehigh" Pulverized Limestone, -----	W. H. Stout, Pinegrove, -----	0.06
C-472	"Lehigh" Pulverized Limestone, -----	W. H. Stout, Pinegrove, -----	0.04
MICHIGAN LIMESTONE AND CHEM- ICAL CO., BUFFALO, N. Y.			
C-456	Calcite Brand Ground Agricultural Lime- stone.	Gibson & Clark Co., Indiana, -----	0.04
C-427	Calcite Brand Ground Agricultural Lime- stone.	A. T. Larson, Kane, -----	0.04
C-435	Calcite Brand Ground Agricultural Lime- stone.	W. A. Smith & Son, Willawana, -----	0.06
PALMER LIME AND CEMENT CO., NEW YORK, N. Y.			
C-486	Ground Limestone, -----	E. A. & J. L. Pennock, Chatham, -----	0.06
SOLVAY PROCESS CO., SYRACUSE N. Y.			
C-436	Solvay Pulverized Limestone, -----	John I. Ford & Son, Chemung, -----	0.43
C-520	Solvay Pulverized Limestone, -----	E. H. Johnson, Ulster, -----	0.00

ARTIFICIAL CARBONATE OF LIME AND MARL.

Calcium Oxide.		Calcium Carbonate.		Magnesium Oxide.		Magnesium Carbonate.		Insoluble matter.	Fineness.					Selling price per ton at place of selection.	Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.		Coarsest Particles Pass Sieve Mesh No.—		Amount of Sample Passing Sieve Meshes.				
									Found.	Guaranteed.	10 mesh.	50 mesh.	100 mesh.		
%	%	%	%	%	%	%	%	%	No.	No.	%	%	%		
45.67	-----	81.56	80.00	0.54	-----	1.13	1.50	13.30	20	10	100.0	83.2	69.2	\$4 50	C- 391
46.76	-----	83.42	80.00	0.64	-----	1.34	1.50	12.56	10	10	100.0	81.1	65.8	6 00	C- 480
47.59	47.60	84.98	85.00	0.70	0.42	1.46	0.75	10.87	10	10	100.0	84.8	74.0	6 00	C- 431
46.14	47.60	82.31	85.00	0.80	0.42	1.67	0.75	11.28	10	10	100.0	86.0	73.6	-----	C- 517
51.18	50.50	91.39	90.00	0.81	1.40	1.89	2.50	6.89	10	20	100.0	59.6	35.6	6 50	C- 361
51.38	51.50	91.66	95.50	0.99	1.30	2.07	2.30	5.89	10	-----	100.0	48.8	36.0	10 00	C- 393
46.80	-----	83.49	90.00	3.20	-----	6.88	3.00	8.18	20	10	100.0	94.8	82.4	8 50	C- 448
48.57	50.00	86.64	90.00	2.17	-----	4.55	3.00	7.21	20	10	100.0	97.6	83.8	6 00	C- 444
47.46	50.00	84.76	90.00	3.69	-----	7.72	3.00	7.55	10	10	100.0	94.8	88.0	10 00	C- 392
48.03	48.50	85.68	-----	2.69	1.90	5.63	-----	7.60	30	10	100.0	93.1	90.8	13 50	C- 459
47.69	50.00	85.07	90.00	2.32	-----	4.86	3.00	9.28	20	10	100.0	98.0	90.4	8 50	C- 438
49.08	50.00	87.55	90.00	2.03	-----	4.24	3.00	7.70	20	10	100.0	97.2	88.8	19 00*	C- 414
47.16	48.50	84.13	-----	1.89	1.90	3.95	-----	9.20	20	10	100.0	95.7	86.0	14 00	C- 464
47.76	50.00	85.20	90.00	3.98	-----	8.32	3.00	6.96	20	10	100.0	97.2	86.4	8 00	C- 395
48.99	-----	87.39	90.00	2.51	-----	5.24	3.00	7.50	20	10	100.0	96.8	88.0	6 64	C- 418
49.00	50.00	87.41	90.00	1.96	-----	4.10	3.00	7.09	40	10	100.0	99.6	89.2	6 00	C- 445
47.02	48.50	83.88	90.00	3.56	1.90	7.45	3.00	7.40	10	10	100.0	94.8	82.8	6 00	C- 348
48.25	48.50	86.07	-----	1.38	1.90	2.90	-----	8.94	30	10	100.0	96.4	93.8	14 00	C- 466
48.65	47.60	86.79	85.00	0.61	0.84	1.28	1.50	9.74	30	10	100.0	95.1	85.2	6 00	C- 457
29.16	-----	52.02	47.43	19.18	-----	40.11	40.75	9.00	10	-----	100.0	87.2	80.4	-----	C- 470
28.84	-----	50.44	47.43	22.13	-----	46.23	40.75	8.36	10	-----	100.0	91.2	83.2	5 50	C- 358
28.70	-----	51.20	47.43	19.34	-----	40.45	40.75	8.24	10	-----	100.0	84.9	76.6	6 00	C- 472
55.29	54.50	98.63	97.00	0.76	1.00	1.59	2.00	0.50	20	-----	100.0	68.7	54.6	7 00	C- 456
54.79	54.50	97.84	97.00	0.73	1.00	1.53	2.00	0.73	10	-----	100.0	62.0	46.4	5 00	C- 497
54.90	54.50	98.04	97.00	0.72	1.00	1.51	2.00	0.49	10	-----	100.0	66.4	50.0	5 00	C- 435
58.31	48.00	95.10	86.50	1.79	5.00	3.74	-----	1.96	10	20	100.0	68.7	74.0	7 20	C- 486
48.02	51.20	85.63	94.00	2.41	1.50	5.05	-----	7.40	40	20	100.0	96.0	82.8	4 00	O- 436
48.19	51.20	85.97	94.00	2.25	1.50	4.71	-----	9.38	20	20	100.0	86.8	72.8	6 75	O- 520

*Excluded from average. Estimated from bag price.

TABLE I.—PULVERIZED LIMESTONE ARTIFICIAL

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—	Moisture.
	CHARLES WARNER CO., WILMINGTON, DEL.		%
C- 483	Pulverized Limestone, -----	John P. Sharpless, Avondale, -----	0.09
		Average, -----	0.09
	ARTIFICIAL CARBONATE OF LIME.		
	THE COLUMBIA PRODUCTS CO., CLEVELAND, OHIO.		
C- 482	Plant Lime, -----	F. P. Allen & Co., Titusville, -----	0.63
C- 422	Plant Lime, -----	W. H. Dunlap, Jr., Canonsburg, -----	0.44
C- 452	Plant Lime, -----	H. F. Gelbach, Evans City, -----	0.75
C- 366	Plant Lime, -----	Krause & Freehling, Marwood, -----	0.32
C- 341	Plant Lime, -----	J. F. McClain, Miola, -----	0.59
C- 390	Plant Lime, -----	W. D. Ripley, Wesleyville, -----	0.48
	INDUSTRIAL CHEMICAL CO., NEW YORK, N. Y.		
C- 432	Precipitated Agricultural Lime, -----	Jones Evason, Christiana, -----	0.54
C- 377	Precipitated Agricultural Lime, -----	Hoffman & Dietrich Co., Kutztown, -----	0.53
C- 503	Precipitated Agricultural Lime, -----	Milton Long, Robesonia, -----	0.20
C- 368	Precipitated Agricultural Lime, -----	R. J. Toepfer, Tarentum, -----	0.37
C- 397	Precipitated Agricultural Lime, -----	I. G. Williams, Ariel, -----	0.44
	NORWICH CHEMICAL CO., SMETHPORT, PA.		
C- 428	Norwich Carbonate of Lime, -----	Wm. M. Farnham, Smethport, -----	11.45
C- 388	Norwich Carbonate of Lime, -----	C. H. Rich, Woolrich, -----	17.11
		Average, -----	2.60
	MARL.		
	CONNEAUT LAKE MARL CO., HARMONSBURG, PA.		
C- 481	Conneaut Marl Lime, -----	Clyde D. Duffec, Oil City, -----	1.32
C- 355	Conneaut Marl Lime, -----	H. J. Klingler & Co., Butler, -----	5.05
C- 504	Conneaut Marl Lime, -----	J. H. Young, -----	2.86
		Average, -----	3.07

[illegible]

TABLE II.—LIME

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
LIME.		
C-380	CALCIUM PRODUCTS CO., HOLLI- DAYSBURG, PA. Calcium Brand Agricultural Lime, -----	Isaiah Sherbine, Wilmore, -----
C-426	M. J. GROVE LIME CO., LIME KILN, MD. Famous Frederick County Ground Lime,--	W E. Sawyer, Wrights, -----
C-396	LUTHER KELLER, SCRANTON, PA. Agricultural Lime, -----	Frank Woolbacker, Daleville, -----
C-405	QUARRYVILLE LIME AND STONE CO.. QUARRYVILLE, PA. Loose Lime, -----	Quarryville Lime & Stone Co., Quarryville,
C-449	VANCE CO., WINFIELD, PA. Dry Valley Burned Lime, -----	Vance Co., Winfield, -----
C-501	CHARLES WARNER CO., WILMING- ONT, DEL. Pulverized Burned Lime, -----	Henry R. Stump, Lenhartsville, ----- Average, -----
HYDRATED LIME.		
AMERICAN LIME AND STONE CO.,		
TYRONE, PA.		
C-437	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	Edw. Allen, West Franklin, -----
C-488	Hydra Oxide (H-O) of Lime for Agri- culture Use.	Coburn Grain & Creamery Co., Coburn,--
C-398	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	Frank Douglas, Indiana, -----
C-369	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	R. J. Dunham, Wellsboro, -----
C-353	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	Fulalia Mills, Coudersport, -----
C-407	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	W. S. Henderson, Alexandria, -----
C-381	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	McFarland Supply Co., Greensburg, -----
C-343	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	Punxsutawney Lumber & Supply Co., Punxsutawney.
C-476	Hydra-Oxide (H-O) of Lime for Agri- cultural Use.	Cloyd Way, Cessna, -----
C-430	BEAVER VALLEY LIME CO., ELL- WOOD CITY, PA. Beaver Valley Hydrated Lime, -----	G. W. Walter Hardware Co., Beaver, ---
BLAIR LIMESTONE CO., MARTINS- BURG, W. VA.		
C-429	Opequon Hydrated Lime, -----	Wm. M. Atkinson, McVeytown, -----
C-420	Opequon Hydrated Lime, -----	C. S. Hunter Co., Washington, -----
C-412	Opequon Hydrated Lime, -----	L. H. Leiter & Bro., Greencastle, -----
C-510	Opequon Hydrated Lime, -----	L. H. Leiter & Bro., Greencastle, -----
C-516	Opequon Hydrated Lime, -----	S. S. Mosholder, Rockwood, -----
C-421	Opequon Hydrated Lime, -----	George B. Sprowls, Claysville, -----

AND HYDRATED LIME.

Calcium Oxide.		Magnesium Oxide.		Carbon dioxide.	Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.				
%	%	%	%	%	%		
79.90	94.25	1.23	0.30	0.35	3.84	-----	C- 380
62.17	70.00	7.39	5.00	10.42	7.54	\$11 00	C- 426
58.85	70.00	5.04	3.00	13.22	3.00	5 25	C- 396
51.71	50.00	1.50	2.00	12.72	8.78	6 05	C- 405
89.82	85.00	1.48	2.00	1.16	1.03	-----	C- 449
54.00	53.00	37.33	37.00	1.66	2.94	-----	C- 501
66.08	-----	9.00	-----	6.59	4.52	\$7 43	-----
63.43	65.00	2.50	-----	-----	3.93	11 00	C- 437
65.11	65.00	1.96	-----	-----	4.00	10 95	C- 488
66.87	65.00	2.46	-----	-----	8.44	10 50	C- 398
67.24	65.00	1.44	-----	-----	3.14	-----	C- 369
58.96	65.00	1.94	-----	-----	3.30	10 13	C- 353
67.63	65.00	1.39	-----	-----	2.73	10 00	C- 407
69.46	65.00	1.87	-----	-----	3.51	12 00	C- 381
62.53	65.00	2.31	-----	-----	2.18	11 00	C- 343
65.56	65.00	2.19	1.00	-----	3.82	11 50	C- 476
53.68	57.69	1.10	1.10	-----	6.52	10 00	C- 430
67.08	65.00	1.76	2.00	-----	2.21	9 50	C- 429
65.77	65.00	1.77	2.00	-----	3.26	11 00	C- 429
65.99	65.00	1.82	2.00	-----	4.65	9 50	C- 412
61.32	65.00	3.55	2.00	-----	7.02	11 50	C- 510
65.05	65.00	1.64	2.00	-----	4.24	9 50	C- 516
64.78	65.00	1.72	2.00	-----	3.61	10 00	C- 421

TABLE II.—LIME AND

Chemist's number.	Sample Taken From—	Name of Manufacturer and Brand.
	G. & W. H. CORSON, PLYMOUTH MEETING, PA.	
C- 351	Corson's Prepared Lime (Hydrated,) ----	Edw. Brinton & Sons, West Chester, ----
	DIETRICK BROTHERS, READING, PA.	
C- 500	Dietrick's Gold Medal Brand Hydrated Lime.	Centerport Grange, Berne, ----
	THE KELLEY ISLAND LIME AND TRANSPORT CO., CLEVELAND, OHIO.	
C- 423	Tiger Brand Agricultural Hydrated Lime,	E. D. Everts, Warren, ----
C- 383	Tiger Brand Agricultural Hydrated Lime,	F. E. Gant, Jeannette, ----
C- 384	Tiger Brand Agricultural Hydrated Lime,	James McCullough & Son, Kittanning, ----
C- 400	Tiger Brand Agricultural Hydrated Lime,	Muth Bros., Elizabethtown, ----
C- 518	Tiger Brand Agricultural Hydrated Lime,	C. N. Savage Hardware Co., California,--
	KNICKERBOCKER LIME CO., PHILADELPHIA, PA.	
C- 487	Knickerbocker Hydrated Lime; ----	R. C. Fairlamb & Son, Brandywine Summit.
C- 403	Knickerbocker Hydrated Lime, ----	W. H. D. Godshall, Colmar, ----
C- 354	Knickerbocker Hydrated Lime, ----	J. M. Gring Co., Reading, ----
C- 374	Knickerbocker Hydrated Lime, ----	H. H. Martin, Manheim, ----
C- 502	Knickerbocker Hydrated Lime, ----	J. M. Oping Co., Reading, ----
	LEBANON FERTILIZER WORKS, LEBANON, PA.	
C- 471	Levan's Lebanon Valley Hydrated Lime,	Harry Keffler, Pine Grove, ----
	LEGORE COMBINATION LIME CO., LEGORE, MD.	
C- 404	Legore's Hydrated Lime, ----	Miller & Harkins, Hickory Hill, ----
	JOHN D. OWENS & SON CO., OWENS, OHIO.	
C- 519	Clover Leaf Brand Agricultural Hydrate Lime.	Bentleysville Hardware Co., Bentleysville,--
	PALMER LIME AND CEMENT CO., NEW YORK, N. Y.	
C- 359	Bethlehem Brand Hydrated Lime, ----	Lewis Beltz, Lehighton, ----
C- 371	Challenge Brand Hydrated Lime, ----	Brackbill & Leaman, Strasburg, ----
C- 401	Challenge Brand Hydrated Lime, ----	Amos Ely & Co., Leaman Place, ----
C- 349	Challenge Brand Hydrated Lime, ----	C. B. M. Frey, Muncy, ----
C- 385	Challenge Brand Hydrated Lime, ----	Meno Graybill & Sons, Bareville, ----
C- 352	Challenge Brand Hydrated Lime, ----	E. H. Keen & Co., Parkesburg, ----
C- 485	Challenge Brand Hydrated Lime, ----	E. A. & J. L. Pennock, Chatham, ----
C- 364	Challenge Brand Hydrated Lime, ----	R. P. Raymond, Middletown, ----
C- 450	Challenge Brand Hydrated Lime, ----	Unknown.
C- 347	Snow Flake Brand Hydrated Lime, ----	Annville Lime Co., Annville, ----
C- 475	Snow Flake Brand Hydrated Lime, ----	George Maurer, Pitman, ----
C- 446	Snow Flake Brand Hydrated Lime, ----	John J. Peters, Claussville, ----
	THE PARAGON PLASTER AND SUPPLY CO., BLOOMSBURG, PA.	
C- 514	Paragon Hydrate Lime, ----	Robert Batian, Waymart, ----
C- 417	Paragon Hydrate Lime, ----	B. J. Gardener, Factoryville, ----
C- 515	Paragon Hydrate Lime, ----	J. A. Sequine, Cresco, ----
C- 408	Paragon Hydrate Lime, ----	Boyd Stiler, Bloomsburg, ----
C- 490	Paragon Hydrate Lime, ----	G. Streeter, Scranton, ----
C- 434	Paragon Hydrate Lime, ----	Wysox Produce Co., Wysox, ----

HYDRATED LIME.—Continued.

Calcium Oxide.		Magnesium Oxide.		Carbon dioxide.	Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.				
%	%	%	%	%	%		
45.77	42.00	31.25	27.00	-----	1.34	\$11 00	C- 351
46.62	46.00	29.59	32.00	-----	2.12	-----	C- 500
47.62	54.00	32.00	16.00	-----	0.17	10 00	C- 423
63.56	54.00	10.49	16.00	-----	0.60	11 50	C- 383
54.64	53.00	22.10	21.00	-----	0.95	11 25	C- 384
44.02	54.00	29.23	16.00	-----	0.02	*20 00	C- 400
46.42	53.00	30.93	21.00	-----	1.36	13 25	C- 518
46.46	45.00	31.82	30.00	-----	2.02	14 00	C- 487
47.76	45.00	32.30	30.00	-----	1.22	11 50	C- 403
47.36	45.00	31.78	30.00	-----	1.30	11 50	C- 354
49.36	45.00	32.63	30.00	-----	0.14	10 00	C- 374
46.30	45.00	31.68	30.00	-----	1.76	14 50	C- 502
57.35	65.00	15.50	3.00	-----	4.02	-----	C- 471
57.20	50.00	5.72	1.00	-----	5.89	-----	C- 404
57.02	55.00	13.33	12.00	-----	3.60	9 25	C- 519
69.13	65.00	2.62	3.00	-----	0.43	10 50	C- 359
66.39	70.00	5.55	3.00	-----	0.20	12 00	C- 371
67.19	70.00	4.32	3.00	-----	0.64	11 00	C- 401
67.97	70.00	3.58	3.00	-----	0.60	12 00	C- 349
65.61	70.00	7.98	3.00	-----	0.40	12 00	C- 385
65.47	70.00	6.74	3.00	-----	0.08	11 00	C- 352
63.51	70.00	9.60	3.00	-----	1.92	13 75	C- 485
70.90	70.00	2.59	3.00	-----	0.19	14 00	C- 364
65.49	70.00	4.67	3.00	-----	1.76	13 00	C- 450
57.59	65.00	13.14	3.00	-----	1.80	-----	C- 347
54.51	65.00	18.81	3.00	-----	3.82	-----	C- 475
56.41	65.00	15.49	3.00	-----	2.11	10 50	C- 446
69.60	63.67	1.97	2.00	-----	3.70	9 00	C- 514
59.66	63.67	1.25	2.00	-----	1.48	11 00	C- 417
59.94	63.67	2.14	2.00	-----	6.23	15 00	C- 515
65.98	63.67	1.63	2.00	-----	4.46	8 00	C- 408
61.27	63.67	1.74	2.00	-----	4.00	10 00	C- 490
63.74	63.67	1.83	2.00	-----	3.73	11 00	C- 434

*Excluded from average. Estimated from bag price.

TABLE II.—LIME AND

Chemist's number.	Sample Taken From—	Name of Manufacturer and Brand.
	READING CHEMICAL CO., READING, PA.	
C- 499	Peerless Brand Hydrated Lime, -----	Robert Docker, Monocacy, -----
C- 469	Peerless Brand Hydrated Lime, -----	Nathan Hunsicker, Snyders, -----
C- 346	Peerless Brand Hydrated Lime, -----	Unknown, -----
	ROBERT A. REICHARD, ALLEN-TOWN, PA.	
C- 468	Reichard's Lehigh Hydrated Lime, -----	Thos. Beltz, Lebigton, -----
C- 373	Reichard's Lehigh Hydrated Lime, -----	L. K. Zeigler, Lititz, -----
	ROSE POINT STONE AND LIME CO., NEW CASTLE, PA.	
C- 419	Peerless Hydrated Lime, -----	T. J. Hager, Farmington, -----
C- 363	Peerless Hydrated Lime, -----	Hibner Hoover Hardware Co., DuBols, -----
C- 506	Peerless Hydrated Lime, -----	Hibner Hoover Hardware Co., DuBols, -----
C- 356	Peerless Hydrated Lime, -----	George Ifft & Son, Evans City, -----
C- 424	Peerless Hydrated Lime, -----	Lanson Bros., Tionesta, -----
	SECURITY CEMENT AND LIME CO., HAGERSTOWN, MD.	
C- 357	Berkeley Hydrated Lime, -----	Francis Baker, Everett, -----
C- 479	Berkeley Hydrated Lime, -----	Briggs Bros., Mt. Unlon, -----
C- 509	Berkeley Hydrated Lime, -----	S. A. Fishburn, Penbrok, -----
C- 365	Berkeley Hydrated Lime, -----	Unknown, -----
	STEACY & WILTON CO., WRIGHTSVILLE, PA.	
C- 410	"Sterling" Brand Hydrated Lime, -----	Biglerville Warehous Co., Biglerville, -----
C- 489	"Sterling" Brand Hydrated Lime, -----	Herman & Bolig, Selinsgrove, -----
C- 511	"Sterling" Brand Hydrated Lime, -----	F. C. Boyer, -----
C- 387	"Sterling" Brand Hydrated Lime, -----	A. B. Groff, New Holland, -----
C- 508	"Sterling" Brand Hydrated Lime, -----	James K. Lewis, Honeybrook, -----
	TIDEWATER PORTLAND CEMENT CO., BALTIMORE, MD.	
C- 411	Tidewater Hydrated Lime, -----	Diehl, Omwake & Diehl, Chambersburg, --
	CHARLES WARNER CO., WILMINGTON, DEL.	
C- 415	Cedar Hollow Limoid, -----	Ablington Lumber Co., Dalton, -----
C- 376	Cedar Hollow Limoid, -----	Tillman Ballett, New Ringgold, -----
C- 402	Cedar Hollow Limoid, -----	S. Carl Garner, Hatboro, -----
C- 447	Cedar Hollow Limoid, -----	R. W. Grammes, Orefield, -----
C- 484	Cedar Hollow Limoid, -----	Thomas Haines Co., Malvern, -----
C- 375	Cedar Hollow Limoid, -----	Lancaster County Farmers Association, Inc., Lancaster. -----
C- 378	Cedar Hollow Limoid, -----	E. & J. W. Leaver, Boyertown, -----
C- 345	Cedar Hollow Limoid, -----	Schwoyer & Savage, Robesonia, -----
C- 455	Cedar Hollow Limoid, -----	C. L. Shipman, Hugbesville, -----
C- 440	Cedar Hollow Limoid, -----	C. A. Stark, Springville, -----
C- 394	Cedar Hollow Limoid, -----	The Summit Lumber Co., Clarks Summit, -----
C- 467	Cedar Hollow Limoid, -----	J. A. Werner, Weatherly, -----
		Average, -----

HYDRATED LIME—Concluded.

Calcium Oxide.		Magnesium Oxide.		Carbon dioxide.	Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.				
%	%	%	%	%	%		
57.48	65.00	17.07	3.00	-----	3.00	-----	C- 499
54.38	65.00	18.47	3.00	-----	3.40	-----	C- 469
55.46	65.00	14.11	3.00	-----	0.30	-----	C- 346
69.63	65.00	2.22	3.00	-----	1.16	\$11 75	C- 468
47.87	65.00	32.41	3.00	-----	0.02	10 60	C- 373
73.69	60.00	0.83	1.50	-----	5.48	-----	C- 419
50.75	60.00	1.00	1.50	-----	0.74	-----	C- 363
54.54	60.00	2.49	1.50	-----	10.40	12 50	C- 506
47.42	60.00	0.87	1.50	7.36	15.84	9 25	C- 356
55.45	60.00	1.07	1.50	-----	8.30	10 00	C- 424
66.90	70.00	2.76	2.00	-----	0.18	12 00	C- 357
67.68	70.00	2.22	2.00	-----	1.02	13 00	C- 479
67.36	70.00	1.92	2.00	-----	0.70	14 00	C- 509
70.23	70.00	1.41	2.00	-----	0.07	11 00	C- 365
67.63	68.20	4.51	2.00	-----	1.85	11 50	C- 410
68.91	68.20	2.90	2.00	-----	3.30	12 00	C- 489
67.90	68.20	3.51	2.00	-----	4.10	12 00	C- 511
70.16	68.20	3.44	2.00	-----	2.54	12 00	C- 387
65.14	68.20	4.85	2.00	-----	2.64	13 00	C- 508
64.91	71.00	0.98	0.50	-----	3.07	12 50	C- 411
47.25	42.00	32.02	28.00	-----	1.18	13 00	C- 415
47.87	42.00	31.12	28.00	-----	1.67	-----	C- 376
46.22	42.00	30.50	28.00	-----	1.20	13 00	C- 402
46.06	42.00	30.93	28.00	-----	1.06	14 00	C- 447
44.48	42.00	28.76	28.00	-----	2.08	11 75	C- 484
46.99	42.00	30.90	28.00	-----	1.49	10 00	C- 375
46.34	42.00	30.33	28.00	-----	1.54	12 00	C- 378
50.18	42.00	28.98	28.00	-----	0.92	10 00	C- 345
43.80	42.00	28.29	28.00	-----	2.10	14 00	C- 455
46.38	42.00	32.79	28.00	-----	1.25	11 00	C- 440
46.88	42.00	31.71	28.00	-----	1.23	13 00	C- 394
45.54	42.00	30.99	28.00	-----	2.52	-----	C- 467
58.39	-----	12.39	-----	-----	2.61	\$11 46	-----

TABLE III.—GYPSUM

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
C- 507	THE AMERICAN AGRICULTURAL CHEMICAL CO., NEW YORK, N. Y.	H. L. Orr, Tyrone, -----
C- 406	Ground Land Plaster, -----	Stultz Bros., Hollidaysburg, -----
C- 350	Ground Land Plaster, -----	George M. Walter, Milton, -----
		Average, -----

TABLE IV.—

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
C- 524	AMERICAN ALKALI AND ACID CO., BRADFORD, PA.	C. W. Gleason, Oil City, -----
	*Agricultural Lime, -----	
C- 379	SECURITY CEMENT AND LIME CO., FAGERSTOWN, MD.	Charles Huston & Brother, Three Springs, -----
C- 409	Berkeley Hydra-Calcite, -----	G. C. Myers, Gardners, -----
	Berkeley Hydra-Calcite, -----	Average, -----

*No guarantees filed with Department.

OR LAND PLASTER.

Moisture.	Calcium Oxide.		Sulphur Tri-Oxide.		Gypsum (Estimated CaSO_4).	Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
	Found.	Guaranteed.	Found.	Guaranteed.				
%	%	%	%	%	%	%		
1.19	33.75	30.48	42.50	45.00	72.29	2.30	\$18 00	C- 507
13.23	32.94	30.48	42.39	45.00	72.10	1.44	16 50	C- 406
11.86	31.89	30.48	41.07	45.00	69.86	3.10	17 50	C- 350
8.77	32.86	-----	41.99	-----	71.42	2.23	\$17 33	-----

MISCELLANEOUS SAMPLES.

Moisture.	Calcium Oxide.		Magnesium Oxide.		Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
	Found.	Guaranteed.	Found.	Guaranteed.			
%	%	%	%	%	%		
-----	58.78	-----	0.72	-----	0.88	\$6 00	C- 524
0.11	61.70	20.00	2.08	2.00	0.57	10 00	C- 379
0.08	57.75	20.00	2.59	2.00	0.78	7 50	C- 409
0.09	59.41	-----	1.80	-----	0.74	\$7 83	-----



